REMARKS

An RCE and fee is filed with this Amendment. Further examination is requested. Claims 1-12 and 21-35 are in the application. Responsive to the Examiner's comments at paragraph 15 of the 1/27/2005 Final Office Action, the claims have been amended so that all of the independent claims now describe pulling liquid (or liquid pulled) from the workpiece as described at 0009. In several of the claims, "vapor" has been changed to "vapor or aerosol", as either may be used, as described at 0029.

The claims describe novel methods for cleaning and drying a workpiece. The methods, in a basic form, need only relatively inexpensive and environmentally friendly substances, e.g., water and an organic solvent, such as isopropyl alcohol (IPA). The claimed methods can advantageously also be carried out within a single processing vessel. This requires less clean room space in the fab or factory, and also reduces the potential for defects in the end products (e.g., semiconductor devices), as the workpieces can be cleaned and dried with less handling and movement.

Regarding the rejections at paragraph 6 of the Final Office Action, Ferrell et al., USP 5,974,689, describes a chemical drying and cleaning system which uses a first liquid, which is DI water or IPA, followed by a second liquid, specifically hydrofluoroether (HFE). Column 2, lines 61-67 and Column 3, lines 20-30. As is clear from Cols. 3-5, in Ferrell et al. the objective is to use HFE or a solution containing HFE to <u>displace</u> the first liquid. Ferrell et al. uses HFE because it can displace IPA, water, and most other liquid substances. Column 3, lines 41-46. HFE

displaces the first liquid (water or IPA) because it is has a higher density than the first liquid. HFE also has a lower surface tension.

In contrast to the displacement mechanism of Ferrell et al., all of the claims now describe use of an organic solvent, or a surface tension lowering step, that results in pulling liquid from the wafer surface. See the Application at 0009. Hence, the claims now describe a surface tension effect, rather than a displacement effect as disclosed in Ferrell et al.

The claimed surface tension drying mechanism of the claims is entirely different from displacement/evaporation mechanism in Ferrell et al. Indeed, a principal advantage of the surface tension drying mechanism is that it specifically avoids evaporation -- because evaporation ordinarily tends to leave watermarks or similar deposits resulting in contamination of the workpiece. In the pending claims, the workpiece is dried as it is removed from the aqueous solution. No follow on displacement step is used or needed. (See claims 1 and 35, describing "raising the workpiece...to dry the workpiece"; and claims 31 and 34 describing "...thereby leaving the workpiece substantially dry...). Ferrell et al. does not suggest these steps, because in Ferrell et al., an additional separate drying step is needed after withdrawing the workpieces from the processing liquid. See e.g., Ferrell et al. Fig. 2.

While Ferrell et al. discloses use of sonics while withdrawing the workpieces, there is no suggestion in Ferrell et al. for use of a surface tension drying technique, as claimed. Applying sonic energy as the wafer is removed from the bath of liquid, in combination with a surface tension drying technique, has several beneficial effects which are not suggested by Ferrell et al. Continuing to apply sonic energy provides

an energetic environment which helps to thin the boundary layer of liquid at the gas/liquid interface. This increases interaction between the liquid and the gas to promote drying, and helps to prevent particle re-adhesion at the interface. Since Ferrell et al. relies on a displacement drying technique, it does not suggest the use of surface tension drying with sonics, as claimed.

Turning to the rejections at paragraph 8 of the 1/27/2005 Final Office Action, Andreas et al., US Patent No. 6,273,100 B1, describes a cleaning method where megasonics are applied while the wafers are in the bath of liquid. The wafers are then removed entirely from the liquid and are dried using a surface tension gradient or Marangoni method. This drying is an entirely <u>separate</u> step necessarily performed <u>after</u> the megasonic cleaning. Indeed, in Andreas et al., the drying is carried out in a separate drying chamber 30, which is separated from the cleaning or submersion chamber 10 by a wall 32. Col. 4, lines 54-61; Col. 6, lines 29-34. Fig. 5 in Andreas et al. shows a combined submersion and drying chamber. Col. 7, lines 42-48. However, even in this embodiment, the drying is performed only after the wafers are entirely withdrawn from and above the bath of liquid. Col. 8, lines 8-10. Hence, in Andreas et al., the sonic cleaning step and the drying step are necessarily performed only and separate and different times and places. In contrast, the claims describe application of sonic energy <u>simultaneously</u> with the drying step. For example, claim 1 describes application of the organic vapor to perform the surface tension drying, and <u>continuing sonic agitation while the liquid-vapor interface passes across the workpiece surface.</u>

In the claimed methods, the drying is eliminated as a distinctly separate or different process from cleaning. Rather, the drying step effectively also becomes a cleaning step. There is no distinct "drying" step, as drying is made to occur as part of the cleaning step. The claims are accordingly patentably over Andrews et al.

In addition, in Andreas et al., the drying fluid is applied only above the bath of liquid. On the other hand claims 21 and 34 describe applying the alcohol or solvent onto the surface of the bath of liquid.

In view of the foregoing, it is submitted that the claims are allowable. A Notice of Allowance is requested.

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Respectfully submitted,

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